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PREDICTORS OF INADEQUATE GESTATIONAL WEIGHT GAIN AMONG AFRICAN AMERICANS AND NON-HISPANIC WHITES

by

Elizabeth Barnett, PhD
Trude Bennett, DrPH

ABSTRACT

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Inadequate maternal weight gain during pregnancy is the second leading determinant of low birth weight in industrialized nations, preceded only by cigarette smoking. In this study, maternal sociodemographic, nutritional, behavioral, health services, and reproductive history risk factors were investigated as potential predictors of inadequate weight gain in a large (n=47,629) population of low-income women who were underweight or normal weight prior to pregnancy, and who delivered full-term infants. Two outcomes were analyzed: gain of less than 15 pounds at term (very inadequate gain) and gain of at least 15 pounds but less than the minimum recommended for prepregnancy body mass (moderately inadequate gain).

Overall, 35.6 percent of African Americans and 25 percent of non-Hispanic whites had inadequate gain. The strongest predictor of poor gain for both race groups was short interbirth interval; the adjusted relative risk of very inadequate gain for women with birth intervals of 12 months or less was 1.5 (95% confidence interval (CI) 1.1-2.1) for African Americans and 2.2 (95% CI 1.4-3.4) for non-Hispanic whites, compared with primiparous women. Cigarette smoking, low education, and being unmarried were also important predictors of poor gain. Timing of entry into prenatal health services was not predictive of poor gain. Compared with normal weight women, underweight women were at lower risk of very inadequate gain but at higher risk of moderately inadequate gain.

Improved access to health services, including family planning, as well as nutrition education, greater food supplementation for high-risk women, and smoking cessation programs may help to reduce the prevalence of low birth weight by contributing to higher gestational weight gains.

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NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

INTRODUCTION

Adequate weight gain may be the best overall indicator of good maternal nutrition during pregnancy. Inadequate maternal weight gain during pregnancy is the second leading determinant of low birth weight in industrialized nations, preceded only by cigarette smoking.¹ Poor maternal weight gain is potentially modifiable with proper prenatal care, making it an important target for efforts to improve maternal and child health.

In underdeveloped nations, low maternal weight gain is commonly the result of malnutrition.¹ However, severe malnutrition is rare in the United States, and the causes of poor gestational weight gain are multifactorial. Negative cultural attitudes toward weight gain, especially by young women; inconsistent advice from physicians and other health care providers; and poor nutritional practices, including inappropriate dieting, may all be important contributors to low pregnancy weight gain.^{2,3} Previous studies have identified low socioeconomic status^{4,5} (measured variously by income, marital status, and/or education), young maternal age,^{6,7} multiparity,⁴ and cigarette smoking^{8,9} as important predictors of inadequate weight gain.

Improving weight gain among pregnant women is an important objective of prenatal health services; however, we must first understand the determinants of poor weight gain. In this study, we investigated maternal sociodemographic, nutritional, behavioral, health services, and reproductive risk factors as potential predictors of poor weight gain in a population of low-income pregnant women who delivered full-term infants. There were several strengths to our study, including the large size of the study population ($n=47,629$), and the availability of data for both African Americans ($n=23,637$) and non-Hispanic whites ($n=23,992$). An important contribution of this study was the broad range of maternal risk factors evaluated as potential determinants of poor weight gain.

In addition, we analyzed two detrimental weight gain outcomes: gain of less than 15 pounds at term

(very inadequate gain), and gain of at least 15 pounds but less than the minimum recommended for body mass (moderately inadequate gain). In an average, uncomplicated pregnancy, the products of conception – fetus, placenta, and amniotic fluid – account for approximately 15 pounds of the weight gained by the mother by the end of term.¹⁰ Additional weight gain contributes to increases in maternal uterine and breast tissue, blood volume, and fat stores. The current recommended range of weight gain for women of normal prepregnancy body mass is 25 to 35 pounds at term.³

METHODS

Study Population and Data Sources

Data were examined from a large population of women who delivered a single full-term (≥ 37 weeks) liveborn infant during 1988-1991 and who participated in the Women, Infants, and Children Supplemental Food Program (WIC) both prenatally and postnatally. Women who delivered preterm were excluded from the study population both because of the difficulties in accurately determining total weight gain for these women, and because adequate weight gain goals have not been defined for short gestations.³ Height, weight, anemia, and smoking data for each woman were collected during the WIC prenatal and postnatal visits and linked to pregnancy risk factor data from birth certificates. Only women whose WIC records matched a birth certificate were included in the study population. Hispanics, American Indians, and Asian Americans were excluded from the study population because the numbers of pregnant women in these ethnic groups were too small for detailed analysis. Data on 87,945 African American and non-Hispanic white women were available for this study. The association between gestational weight gain and infant birth weight appears to be weak among the overweight and obese,¹¹ and controversy remains about the appropriate amount of weight gain for these women.³ Therefore, we excluded 28,853 women who were overweight or obese prior to pregnancy from our analyses. We further excluded 11,463 women for whom any of the study variables were missing. The

final analysis data set contained pregnancy risk factor data for 47,629 normal weight and underweight women.

Definition of Study Variables

Gestational weight gain was calculated by subtracting prepregnancy weight (self-reported at the WIC prenatal visit) from weight immediately prior to delivery (self-reported at the WIC postpartum visit). The recommendations of the 1990 Institute of Medicine report Weight Gain During Pregnancy were used to categorize gestational weight gain.³ Very inadequate gain was defined for all women as gain of less than 15 pounds at term. Moderately inadequate gain was defined as at least 15 pounds, but less than the minimum recommended in the Institute of Medicine report. For normal weight women (pregnancy metric body mass index (BMI) 19.8-26.0) minimum recommended weight gain was 25 pounds at term, while for underweight (BMI 16.5-19.8) and very underweight women (BMI <16.5) weight gain of at least 28 pounds at term was recommended. Minimum recommended weight gain for women who delivered at 37, 38, and 39 weeks was calculated for each BMI group separately using standard weight gain curves.³

Prepregnancy metric BMI was calculated using weight and height data reported during the WIC prenatal visit. Maternal age, education, parity, and marital status data were obtained from the birth certificate. For multiparous women, interbirth interval was defined as the length of time between the delivery date of the current pregnancy and the month and year of the woman's previous live birth.

Cigarette smoking during pregnancy was recorded on both the WIC prenatal record and the birth certificate. A woman was considered a smoker if she was coded as a smoker on either record. Number of cigarettes smoked per day was obtained from the birth certificate. Women who were identified as smokers only on the WIC record were assigned to the lowest category for number of cigarettes smoked per day (1-9 cigarettes). Prenatal

hemoglobin or hematocrit was measured at the time of enrollment in the WIC program. Anemia was categorized using CDC-defined cutpoints that were specific for trimester of measurement, and adjusted for number of cigarettes smoked per day.¹²

Trimester of enrollment in the WIC program was obtained from the prenatal WIC record, while trimester of enrollment in prenatal care was obtained from the birth certificate. The continuity of prenatal care index used in this study is part of the Kotelchuck Index.¹³ In the Kotelchuck Index, continuity of prenatal care was measured by whether a woman received an adequate number of prenatal care visits after the time she entered prenatal care. For example, a woman who did not receive prenatal care until the beginning of the third trimester would have had adequate continuity if she had an appropriate number of visits during the remainder of her pregnancy.

Analytic Methods

To make comparisons easier, identical and separate analyses were conducted for African Americans and non-Hispanic whites. The following maternal risk factors were analyzed as potential predictors of inadequate gestational weight gain: age, education, marital status, cigarette smoking, prepregnancy body mass, blood iron status, trimester of WIC enrollment, trimester of entry into prenatal care, continuity of prenatal care, parity, and interbirth interval. Relative risk estimates and 95 percent confidence intervals for the association between each risk factor and inadequate gestational weight gain, adjusted for all other risk factors, were estimated from logistic regression models. Dummy variables for categories of each risk factor were included in all models. Separate models were run for very inadequate weight gain and moderately inadequate weight gain. The models of very inadequate weight gain excluded women with moderately inadequate gain, while women with very inadequate weight gain were excluded from the models of moderately inadequate gain.

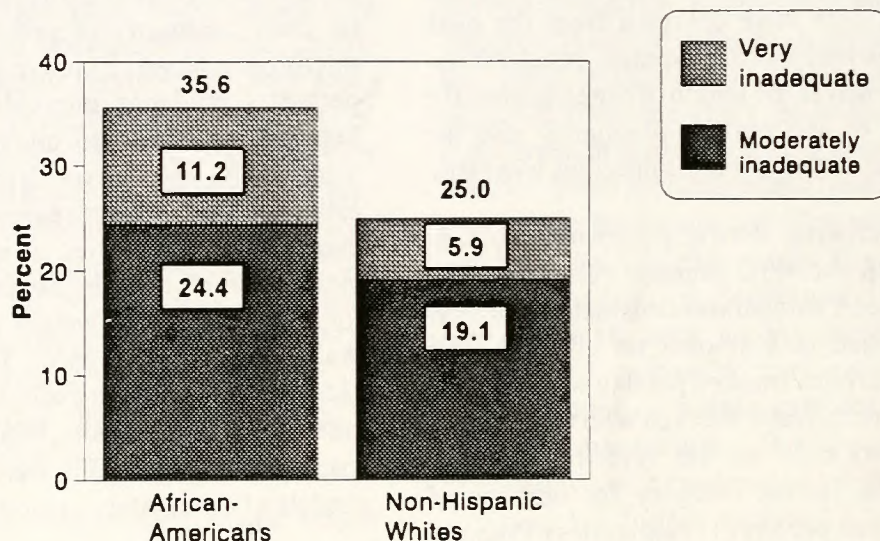
RESULTS

Pregnancy weight gain data were analyzed for 23,992 non-Hispanic white women and 23,637 African American women in this study. Distributions of demographic, nutritional, and medical care characteristics of the two study groups are shown in Table 1. The study groups included only women with below normal or normal prepregnancy body mass; overweight and obese women were not analyzed. Low-income African American women were younger, better educated, and less likely to be married than low-income non-Hispanic white women. Non-Hispanic white women were much more likely to smoke cigarettes during pregnancy and were also heavier smokers than African American women. African American women were more than twice as likely to be anemic. Non-Hispanic white women were more likely to be underweight before pregnancy. Non-Hispanic white women were more likely to receive WIC services and prenatal care in the first trimester, and had better continuity of prenatal care than African American women.

The proportion of women with inadequate gestational weight gain is shown in Figure 1. African Americans were 42 percent more likely than non-Hispanic whites to gain an inadequate amount of weight during pregnancy (35.6% vs. 25.0%). Furthermore, African Americans were almost twice as likely as non-Hispanic whites to have very inadequate weight gain (less than 15 pounds) at term (11.2% vs. 5.9%). Among women who gained less than the minimum recommended amount of weight for their body mass status, approximately one-quarter of non-Hispanic whites gained less than 15 pounds, while approximately one-third of African Americans with inadequate weight gain gained less than 15 pounds.

Maternal sociodemographic characteristics and relative risks of very inadequate and moderately inadequate weight gain during pregnancy from logistic regression analyses are shown in Table 2. Maternal age was not a noteworthy predictor of poor weight gain among non-Hispanic white women; however African Americans aged less than 18 years

Figure 1.
Prevalence of Inadequate Gestational Weight Gain
Among Low-Income Women Who Delivered
a Full-Term Singleton Infant



old were 30 percent more likely to have very inadequate gain compared with those aged 20-34. Having less than a high school education was an important predictor of very inadequate gain among both African Americans and non-Hispanic whites, with relative risks of 1.4 (1.2-1.7) and 1.5 (1.2-1.8) respectively. Compared with women with at least some college education, those with 12 years of education or less were also at slightly increased risk of moderately inadequate weight gain. Women of both races who were unmarried at the time of delivery were at a slightly increased risk of both very inadequate and moderately inadequate gestational weight gain.

Cigarette smoking was a meaningful predictor of both very inadequate and moderately inadequate weight gain, and there was a clear association between the number of cigarettes smoked per day and the risk of poor weight gain for all women (Table 3). Among African Americans, smoking a pack or more of cigarettes per day led to a 50 percent increased risk of very inadequate gain and a 30 percent increased risk of moderately inadequate gain. Among non-Hispanic whites, there was a 60 percent excess of very inadequate gain and a 40 percent excess of moderately inadequate weight gain among women who smoked a pack or more of cigarettes per day. Women in both race groups who were very underweight or moderately underweight prior to pregnancy were at substantially lower risk of very inadequate weight gain compared with normal weight women, but were at markedly increased risk of moderately inadequate weight gain. Anemia was associated with a slight excess risk of both very inadequate and moderately inadequate weight gain among African Americans only.

Timing of access to prenatal medical and nutritional services was not a good predictor of adequacy of gestational weight gain among either African Americans or non-Hispanic whites (Table 4). Trimester of WIC enrollment did not influence either very inadequate or moderately inadequate weight gain. Similarly, trimester of enrollment in prenatal care did not influence adequacy of gestational weight gain, although the small number of women who

received no prenatal care were more likely to gain either a very inadequate or moderately inadequate amount of weight than women who entered prenatal care in the first trimester. However, among African Americans, inadequate continuity of prenatal care was associated with a 50 percent excess risk of very inadequate gain.

Reproductive history was the strongest predictor of inadequate gestational weight gain for both African Americans and non-Hispanic whites, as shown in Table 5. Shorter interbirth intervals were associated with substantially higher risks of both very inadequate and moderately inadequate weight gain. The detrimental effect of short interbirth intervals on gestational weight gain was strongest for non-Hispanic whites: those with an interbirth interval of 12 months or less were 120 percent more likely to gain a very inadequate amount of weight and 110 percent more likely to gain a moderately inadequate amount of weight, compared with women with no previous births. African American women with interbirth intervals of 12 months or less were 50 percent more likely to have either very inadequate or moderately inadequate weight gain, compared with primiparous African Americans. Non-Hispanic white women with three or more previous live births were 60 percent more likely to have very inadequate weight gain compared with those with no previous live births, regardless of interbirth interval.

DISCUSSION

Among both African American and non-Hispanic white women, birth interval of 12 months or less was the strongest predictor of inadequate gestational weight gain in this study, after controlling for multiple risk factors. Short birth interval has been shown to be a serious risk factor for low birth weight, specifically intrauterine growth retardation;^{14,15,16} however, the mechanisms by which short birth intervals contribute to intrauterine growth retardation have not been specified.¹⁶ Our results suggest that inadequate gestational weight gain may be an important intervening factor between short birth interval and low birth weight. It is well established that the physiological changes of pregnancy can result in the depletion of maternal nutritional stores,¹⁷ which are gradually re-established

in the postpartum period. Conception shortly following birth may delay recovery of maternal nutrient stores, with the added physiological demands of the second pregnancy resulting in inadequate weight gain and increased risk of low birth weight.

Even for primiparous women and women with adequate birth spacing, those who are moderately or very underweight prior to pregnancy are seriously compromised nutritionally; adequate weight gain by these women is critical to ensure healthy pregnancy outcomes. Poor weight gain and low body mass have been shown to have independent effects on the risk for low birth weight.^{1,18,19,20,21,22,23} Encouragingly, in this study, underweight women in both race groups were much less likely than normal weight women to gain a very inadequate amount of weight (i.e. less than 15 pounds). This finding is consistent with the assumption that underweight women were identified upon entry into prenatal care and WIC services, and were educated about the need for adequate weight gain. However, despite being at lower risk for very inadequate gain, both very underweight and moderately underweight women were found to be at increased risk of moderately inadequate weight gain.

Cigarette smoking is the leading determinant of low birth weight in the United States.¹ Women who both smoke during pregnancy and have inadequate weight gain suffer much higher rates of low birth weight than women with only one of these risk factors.²⁴ In our study, we found a strong dose-response relationship between number of cigarettes smoked per day and risk of both moderately inadequate and very inadequate weight gain. This finding is consistent with previous research.^{4,8,9,25,26} Lower weight gain by smokers has been attributed in the past to lower food intakes compared with non-smokers. However, in the National WIC evaluation and other studies, it was shown that smokers actually had higher dietary intakes than non-smokers.^{3,27,28,32} Cigarette smoking is thought to lead to decreased gestational weight gain through the following mechanisms: increased metabolic rate; decreased bioavailability of important nutrients such as vitamins B₁₂ and C, folate, zinc, and amino acids; and decreased uteroplacental blood flow.³

Previous studies have shown that participation in the WIC program by low-income women leads to increased energy intake and higher gestational weight gains, as well as decreased rates of low birth weight.^{29,30,31,32} Because our study population was limited to WIC participants and we did not have a non-WIC comparison group, we could not evaluate the overall effect of the supplemental foods and nutrition education provided by the WIC program on gestational weight gain by low-income women. In this study, trimester of WIC enrollment did not influence gestational weight gain.

Methodological Issues

Potential limitations of this study include inaccuracies in the self-reports of prepregnancy weight or end-of-pregnancy weight, either of which could have resulted in misclassification of gestational weight gain. The validity and reliability of self-reported weight and height were found to be high both in a study of non-pregnant women³³ and in a study of pregnant adolescents.³⁴ Both studies found that overweight women tended to underestimate their weights; therefore it is possible that the normal weight groups in this study included a small number of women who were actually overweight. Overall bias in the estimates of body mass and gestational weight gain were probably minimal, given the results of validation studies and the exclusion of overweight and obese women from our study population.

Collecting detailed data about the content of prenatal care, including receipt of nutritional assessment and education, was not feasible for a study population of this size. Future studies of the determinants and patterns of poor gestational weight gain that focus in greater detail on provision of health services both preconceptionally and during pregnancy will provide valuable insights for designing and improving preventive efforts. Similarly, studies that collect more detailed nutritional and behavioral risk factor data for women with short interbirth intervals could help determine if a causal link exists between short birth interval, poor gestational weight gain, and subsequent poor infant outcomes.

Implications for Preventive Services

Several important determinants of inadequate gestational weight gain were identified in this study, including short birth intervals, high parity, cigarette smoking, prepregnancy underweight, low education, and no prenatal care (Tables 6 and 7). African American women appear to be at higher risk of inadequate gestational weight gain than non-Hispanic white women, suggesting that special prevention efforts should be directed to African American communities. Ensuring adequate gestational weight gain by all women will involve not only access to health services during pregnancy and the postpartum period, but will also necessitate greater emphasis on nutrition as part of a comprehensive life cycle approach to women's health.

Ideally, the nutritional problems of low body mass (underweight) and anemia should be resolved before a woman becomes pregnant. Community interventions that target food availability, diet, and access to leisure-time physical activity may be effective in improving the nutritional status of young women. In some cases, poor nutritional status prior to pregnancy may be a symptom of underlying illness; therefore careful medical evaluation and timely referral of women who are very underweight or otherwise nutritionally compromised is essential. Among low-income women, supplemental foods during the postpartum period have been shown to have a positive effect on subsequent pregnancy outcomes.¹⁷ However, due to problems with both funding and outreach, not all eligible low-income women receive WIC services in the postpartum period.

For pregnant women, the Institute of Medicine recommends early identification of those at risk for poor weight gain, careful measurement of weight and height, dietary assessment, and in-depth counseling about appropriate nutrition and the importance of adequate weight gain.³ Counseling should

include a weight gain goal which is agreed upon by the pregnant woman. Nutrition education and monitoring of weight gain should be one component of comprehensive prenatal care services which include assistance with smoking cessation and supplemental foods if needed.

However, even with the best prenatal care services, the problem of short birth intervals and their attendant risks for both mother and child can only be addressed through family planning services, which should ideally be available to women both before they conceive and after they give birth. Short birth intervals may result from mistimed or unwanted pregnancies. Prevention of mistimed and unwanted pregnancies through access to affordable birth control methods will have positive health benefits for both women and their children. However, short birth intervals may sometimes be desired by women. Discussion with a health care provider of the risks associated with very close birth spacing may lead some women to decide to delay their next pregnancy. If for religious, cultural, or family reasons close birth spacing is still desired, nutrition education and counseling in the postpartum period is critical in order to maintain the mother's nutritional status at an optimal level.

In conclusion, improved preventive health services, including family planning, nutrition assessment and education, greater food supplementation for high-risk women, and smoking cessation programs may contribute to higher pregnancy weight gains and reduced prevalences of low birth weight. Among low-income women, increased access to WIC services in the postpartum period would lead to improvements in women's nutritional status and could also facilitate better access to family planning services. However, funding reductions or eligibility restrictions for enhanced prenatal care programs such as WIC, or for comprehensive family planning services would have serious deleterious effects on maternal and infant health outcomes.

Table 1
Prevalence of Pregnancy Risk Factors Among
Low-Income Pregnant Women in North Carolina, 1988-1991

	Non-Hispanic Whites (n=23,992) No. (%)		African Americans (n=23,637) No. (%)	
Age				
<18	3,177	(13.2)	4,244	(18.0)
18-19	4,971	(20.7)	4,534	(19.2)
20-34	15,354	(64.0)	14,377	(60.8)
35+	490	(2.0)	482	(2.0)
Education				
<12 years	11,645	(48.5)	8,862	(37.5)
12 years	9,969	(41.6)	11,539	(48.8)
13+ years	2,378	(9.9)	3,236	(13.7)
Parity				
1	11,924	(49.7)	11,559	(48.9)
2	7,221	(30.1)	6,649	(28.1)
3	3,391	(14.1)	3,434	(14.5)
4+	1,456	(6.1)	1,995	(8.4)
Marital Status				
married	15,645	(65.2)	5,248	(22.2)
unmarried	8,347	(34.8)	18,389	(77.8)
Cigarette Smoking				
none	12,910	(53.8)	18,874	(79.8)
1-9 cigs/day	3,569	(14.9)	2,870	(12.1)
10-19 cigs/day	3,790	(15.8)	1,269	(5.4)
20+ cigs/day	3,723	(15.5)	624	(2.6)
Blood Iron Status				
not anemic	21,181	(88.3)	17,461	(73.9)
anemic	2,811	(11.7)	6,176	(26.1)

Table 1
Prevalence of Pregnancy Risk Factors Among
Low-Income Pregnant Women in North Carolina, 1988-1991 (cont'd)

	Non-Hispanic Whites (n=23,992) No. (%)		African Americans (n=23,637) No. (%)	
Prepregnancy Body Mass				
very underweight	797	(3.3)	484	(2.0)
underweight	7,630	(31.8)	6,034	(25.5)
normal weight	15,565	(64.9)	17,119	(72.4)
Interbirth Interval				
≤12 months between births	258	(1.1)	379	(1.6)
13-18 months between births	1,806	(7.5)	1,916	(8.1)
19-24 months between births	1,935	(8.1)	1,803	(7.6)
25-48 months between births	4,397	(18.3)	3,990	(16.9)
49+ months between births	3,672	(15.3)	3,990	(16.9)
no previous births	11,924	(49.7)	11,559	(48.9)
Trimester of WIC Enrollment				
first trimester	7,286	(30.4)	4,685	(19.8)
second trimester	10,431	(43.5)	11,995	(50.7)
third trimester	6,275	(26.2)	6,957	(29.4)
Trimester of Entry into Prenatal Care				
first trimester	16,217	(67.6)	13,462	(57.0)
second trimester	6,610	(27.6)	8,375	(35.4)
third trimester	1,110	(4.6)	1,682	(7.1)
no prenatal care	55	(0.2)	118	(0.5)
Continuity of Prenatal Care				
adequate	20,581	(85.8)	18,693	(79.1)
intermediate	2,903	(12.1)	3,931	(16.6)
inadequate	508	(2.1)	1,013	(4.3)

Table 2
Sociodemographic Characteristics and Relative Risk of Inadequate Weight Gain
Among Low-Income Pregnant Women in North Carolina, 1988-1991

	<u>Very Inadequate Gain</u>		<u>Moderately Inadequate Gain</u>	
	African Americans RR (95% CI)	Non-Hispanic Whites RR (95% CI)	African Americans RR (95% CI)	Non-Hispanic Whites RR (95% CI)
Age				
<18	1.3 (1.1-1.5)	0.9 (0.7-1.1)	1.2 (1.0-1.3)	1.0 (0.9-1.1)
18-19	1.2 (1.0-1.3)	1.0 (0.8-1.2)	1.1 (1.0-1.2)	1.0 (0.9-1.0)
20-34	1.0	1.0	1.0	1.0
>34	1.1 (0.8-1.5)	0.8 (0.6-1.3)	1.0 (0.8-1.2)	1.3 (1.0-1.6)
Years of Education				
<12	1.4 (1.2-1.7)	1.5 (1.2-1.8)	1.3 (1.2-1.5)	1.2 (1.0-1.3)
12	1.3 (1.1-1.5)	1.3 (1.0-1.6)	1.2 (1.1-1.3)	1.1 (0.9-1.2)
>12	1.0	1.0	1.0	1.0
Marital Status				
unmarried	1.3 (1.2-1.5)	1.2 (1.0-1.3)	1.1 (1.1-1.2)	1.2 (1.1-1.3)
married	1.0	1.0	1.0	1.0

Estimated relative risks are odds ratios from logistic regression models. See Methods for detailed explanation of regression models and variable definitions.

Table 3
Nutritional Status, Cigarette Smoking, and Relative Risk of Inadequate Weight Gain Among Low-Income Pregnant Women in North Carolina, 1988-1991

	<u>Very Inadequate Gain</u>		<u>Moderately Inadequate Gain</u>	
	<u>African Americans</u> RR (95% CI)	<u>Non-Hispanic Whites</u> RR (95% CI)	<u>African Americans</u> RR (95% CI)	<u>Non-Hispanic Whites</u> RR (95% CI)
Cigarette Smoking				
none	1.0	1.0	1.0	1.0
1-9 cigs/day	1.1 (0.9-1.2)	1.1 (0.9-1.3)	1.0 (0.9-1.1)	1.0 (0.9-1.1)
10-19 cigs/day	1.3 (1.1-1.5)	1.4 (1.2-1.6)	1.1 (1.0-1.3)	1.3 (1.2-1.4)
20+ cigs/day	1.5 (1.1-1.9)	1.6 (1.4-1.9)	1.3 (1.1-1.6)	1.4 (1.3-1.5)
Prepregnancy Body Mass				
very underweight	0.7 (0.5-1.0)	0.4 (0.2-0.6)	1.5 (1.2-1.8)	1.3 (1.1-1.6)
moderately underweight	0.6 (0.6-0.7)	0.6 (0.5-0.7)	1.6 (1.5-1.7)	1.5 (1.4-1.7)
normal weight	1.0	1.0	1.0	1.0
Blood Iron Status				
anemic	1.2 (1.1-1.3)	1.1 (0.9-1.3)	1.3 (1.2-1.3)	1.1 (1.0-1.2)
not anemic	1.0	1.0	1.0	1.0

Estimated relative risks are odds ratios from logistic regression models. See Methods for detailed explanation of regression models and variable definitions.

Table 4
Prenatal Care Services and Relative Risk of Inadequate Weight Gain
Among Low-Income Pregnant Women in North Carolina, 1988-1991

	<u>Very Inadequate Gain</u>		<u>Moderately Inadequate Gain</u>	
	African Americans	Non-Hispanic Whites	African Americans	Non-Hispanic Whites
	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Trimester of WIC Enrollment				
first	1.0	1.0	1.0	1.0
second	0.9 (0.8-1.0)	0.8 (0.7-0.9)	1.0 (0.9-1.1)	1.0 (0.9-1.1)
third	1.0 (0.9-1.1)	1.0 (0.8-1.1)	1.0 (0.9-1.1)	1.0 (1.0-1.2)
Trimester of Entry into Prenatal Care				
first	1.0	1.0	1.0	1.0
second	1.1 (1.0-1.2)	1.1 (0.9-1.2)	1.1 (1.0-1.2)	1.0 (1.0-1.1)
third	1.0 (0.9-1.2)	1.2 (0.9-1.5)	1.1 (1.0-1.3)	1.1 (0.9-1.3)
no prenatal care	1.7 (1.0-2.7)	1.4 (0.5-2.3)	1.2 (0.8-2.0)	2.1 (1.1-3.9)
Continuity of Prenatal Care				
adequate	1.0	1.0	1.0	1.0
intermediate	1.1 (1.0-1.2)	0.9 (0.8-1.1)	1.1 (1.0-1.2)	1.1 (1.0-1.2)
inadequate	1.5 (1.3-1.9)	1.0 (0.7-1.5)	1.1 (1.0-1.3)	1.0 (0.8-1.2)

Estimated relative risks are odds ratios from logistic regression models. See Methods for detailed explanation of regression models and variable definitions.

Table 5
Reproductive History and Relative Risk of Inadequate Weight Gain
Among Low-Income Pregnant Women in North Carolina, 1988-1991

	<u>Very Inadequate Gain</u>		<u>Moderately Inadequate Gain</u>	
	<u>African Americans</u> RR (95% CI)	<u>Non-Hispanic Whites</u> RR (95% CI)	<u>African Americans</u> RR (95% CI)	<u>Non-Hispanic Whites</u> RR (95% CI)
Interbirth Interval				
≤12 months	1.5 (1.1-2.1)	2.2 (1.4-3.4)	1.5 (1.2-1.9)	2.1 (1.6-2.8)
13-18 months	1.6 (1.3-1.9)	1.4 (1.1-1.8)	1.5 (1.3-1.7)	1.6 (1.3-1.8)
19-24 months	1.0 (0.8-1.2)	1.3 (1.0-1.6)	1.2 (1.0-1.3)	1.2 (1.0-1.3)
25-48 months	1.1 (1.0-1.3)	1.1 (0.9-1.3)	1.1 (1.0-1.2)	1.1 (1.0-1.2)
≥49 months	0.9 (0.8-1.1)	1.0 (0.8-1.2)	0.9 (0.8-1.1)	1.0 (0.9-1.1)
no previous births	1.0	1.0	1.0	1.0
Previous Live Births				
none	1.0	1.0	1.0	1.0
1	1.1 (1.0-1.3)	1.3 (1.1-1.6)	1.1 (1.0-1.3)	1.3 (1.2-1.5)
2	1.3 (1.0-1.5)	1.7 (1.3-2.1)	1.2 (1.0-1.3)	1.4 (1.2-1.6)
3 or more	1.2 (1.0-1.5)	1.6 (1.2-2.1)	1.2 (1.0-1.4)	1.5 (1.2-1.7)

Estimated relative risks are odds ratios from logistic regression models. See Methods for detailed explanation of regression models and variable definitions.

Table 6
Leading Predictors of Very Inadequate Gestational Weight Gain
Among Low-Income Pregnant Women in North Carolina, 1988-1991

African Americans		Non-Hispanic Whites	
No Prenatal Care	RR = 1.7 (1.0-2.7)	Interbirth Interval < 12 months	RR = 2.2 (1.4-3.4)
Interbirth Interval 13-18 months	RR = 1.6 (1.3-1.9)	Two Previous Live Births	RR = 1.7 (1.3-2.1)
Inadequate Continuity of Prenatal Care	RR = 1.5 (1.3-1.9)	Three or More Previous Live Births	RR = 1.6 (1.2-2.1)
Smoking 20+ Cigarettes per day	RR = 1.5 (1.1-1.9)	Smoking 20+ Cigarettes per day	RR = 1.6 (1.4-1.9)
Interbirth Interval < 12 months	RR = 1.5 (1.1-2.1)	Less than 12 Years of Education	RR = 1.5 (1.2-1.8)

Table 7
Leading Predictors of Moderately Inadequate Gestational Weight Gain
Among Low-Income Pregnant Women in North Carolina, 1988-1991

African Americans		Non-Hispanic Whites	
Moderate Underweight Prior to Pregnancy	RR = 1.6 (1.5-1.7)	Interbirth Interval < 12 months	RR = 2.1 (1.6-2.8)
Very Underweight Prior to Pregnancy	RR = 1.5 (1.2-1.8)	No Prenatal Care	RR = 2.1 (1.1-3.9)
Interbirth Interval < 12 months	RR = 1.5 (1.2-1.9)	Interbirth Interval 13-18 months	RR = 1.6 (1.3-1.8)
Interbirth Interval 13-18 months	RR = 1.5 (1.3-1.7)	Moderate Underweight Prior to Pregnancy	RR = 1.6 (1.4-1.9)
		Three or More Previous Live Births	RR = 1.5 (1.2-1.7)



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Department of Environment, Health, and Natural Resources
State Center for Health and Environmental Statistics
P. O. Box 29538
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